Docket No.: 0267-1689(41912.017900)

NEUTRAL SWITCH TEST MECHANISM FOR A CIRCUIT INTERRUPTER

CROSS REFERENCE TO RELATED APPLICATIONS

This application is related to commonly owned application Serial No. To Be Determined, filed March 20, 2001, entitled Circuit Interrupting Device with Reset Lockout and Reverse Wiring Protection and Method of Manufacture, by inventors Steven Campolo, Nicholas DiSalvo and William R. Ziegler, having attorney docket 0267-1415CIP9(41912.015600), which is a continuation-in-part of application Serial No. 09/379,138 filed August 20, 1999, which is a continuation-in-part of application Serial No. 09/369,759 filed August 6, 1999, which is a continuation-in-part of application Serial No. 09/138,955, filed August 24, 1998, now U.S. Patent No. 6,040,967, all of which are incorporated herein in their entirety by reference.

This application is related to commonly owned application Serial No. To Be Determined, filed March 20, 2001, entitled Reset Lockout for Sliding Latch GFCI, by inventors Frantz Germain, Stephen Stewart, David Herzfeld, Steven Campolo, Nicholas DiSalvo and William R. Ziegler, having attorney docket 0267-1415CIP8 (41912.018100) which is a continuation-in-part of application Serial No. 09/688,481 filed October 16, 2000, all of which are incorporated herein in their entirety by reference.

This application is related to commonly owned application Serial No. To Be Determined, filed March 20, 2001, entitled Reset Lockout Mechanism and Independent

Trip Mechanism for Center Latch Circuit Interrupting Device, by inventors Frantz Germain, Steven Stewart, Roger Bradley, David Chan, Nicholas L. DiSalvo and William R. Ziegler, having attorney docket 0267-1415CIP5(41912.017300), herein incorporated by reference.

This application is related to commonly owned application Serial No. 09/379,140 filed August 20, 1999, which is a continuation-in-part of application Serial No. 09/369,759 filed August 6, 1999, which is a continuation-in-part of application Serial No. 09/138,955, filed August 24, 1998, now U.S. Patent No. 6,040,967, all of which are incorporated herein in their entirety by reference.

BACKGROUND

1. Field

The present application is directed to resettable circuit interrupting devices including without limitation ground fault circuit interrupters (GFCI's). Certain embodiments of the present application are directed to circuit interrupting devices using a neutral fault simulation. Certain embodiments of the present application are directed to circuit interrupting devices including a neutral to neutral test switch.

2. Description of the Related Art

Presently available GFCI devices, such as the device described in commonly owned U.S. Patent 4,595,894, use an electrically activated trip mechanism to mechanically break an electrical connection between the line side and the load side of a GFCI. Such devices are resettable after they are tripped by, for example, the detection

of a ground fault. In the device discussed in the '894 patent, the trip mechanism used to cause the mechanical breaking of the circuit (i.e., the conductive path between the line and load sides) includes a solenoid (or trip coil). A test button is used to test the trip mechanism and circuitry used to sense faults, and a reset button is used to reset the electrical connection between line and load sides.

Commonly owned application Serial No. 09/138,955, filed August 24, 1998, now U.S. Patent No. 6,040,967, which is incorporated herein in its entirety by reference, describes a family of resettable circuit interrupting devices capable of locking out the reset portion of the device if certain conditions exist including the circuit interrupting portion being non-operational or if an open neutral condition, grounded neutral exists. Such device may use a simulated ground fault to initiate a device test.

Commonly owned application Serial No. No. 09/379,138 filed August 20, 1999, which is incorporated herein in its entirety by reference, describes a family of resettable circuit interrupting devices capable of independently tripping and protecting against reverse wiring.

SUMMARY

The present application relates to a resettable circuit interrupting devices that simulate a fault condition by simulating a neutral fault condition. The neutral fault may be simulated by connecting a load neutral line to a line neutral line using a switch to create a feedback path in the sensor that will trigger the circuit interrupter.

Furthermore, the neutral fault may be simulated using a third wire through the transformer or by connecting a load phase line to a line phase line.

The fault switch is preferably configured to facilitate mechanical connection between the line and load neutral paths. However, other known actuators are also contemplated.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the present application are described herein with reference to the drawings in which similar elements are given similar reference characters, wherein:

Fig. 1 is a schematic diagram of a GFCI having an electrical test and bridge circuit according to the present application;

Fig. 2 is a schematic diagram of a GFCI having an independent trip such as a mechanical trip for a test button and an electrical ground fault simulation test for reset lockout according to the present application;

Fig. 3 is a schematic diagram of a GFCI having an independent trip such as a mechanical trip for a test button and a mechanical switch (electrical test) for a neutral fault simulation test for reset lockout according to the present application;

Figs. 4a and 4B is a mechanical switch to effectuate a neutral fault simulation for a GFCI such as that as shown in Application Serial No. TBD, attorney docket 0267-1415CIP9(41912.015600).

DETAILED DESCRIPTION OF EMBODIMENTS

The present application contemplates various types of circuit interrupting devices that are capable of breaking at least one conductive path at both a line side and a load side of the device. The conductive path is typically divided between a line side that connects to supplied electrical power and a load side that connects to one or more loads. As noted, the various devices in the family of resettable circuit interrupting devices include: ground fault circuit interrupters (GFCI's), arc fault circuit interrupters (AFCI's), immersion detection circuit interrupters (IDCI's), appliance leakage circuit interrupters (ALCI's) and equipment leakage circuit interrupters (ELCI's).

For the purpose of the present application, the structure or mechanisms used in the circuit interrupting devices, shown in the drawings and described hereinbelow, are incorporated into a GFCI receptacle suitable for installation in a single-gang junction box used in, for example, a residential electrical wiring system. However, the mechanisms according to the present application can be included in any of the various devices in the family of resettable circuit interrupting devices.

The GFCI receptacles described herein have line and load phase (or power) connections, line and load neutral connections and user accessible load phase and neutral connections. The connections permit external conductors or appliances to be connected to the device. These connections may be, for example, electrical fastening devices that secure or connect external conductors to the circuit interrupting device, as well as conduct electricity. Examples of such connections include binding screws, lugs, terminals and external plug connections.

The above-described features can be incorporated in any resettable circuit interrupting device having neutral fault protection, but for simplicity the descriptions herein are directed to GFCI receptacles.

In one embodiment, the GFCI receptacle has a circuit interrupting portion, a reset portion and a reset lockout as shown in commonly owned application serial no. TBD, attorney docket 0267-1415CIP9(41912.015600).

In an embodiment using a mechanical independent trip test button, the present invention utilizes a neutral fault simulation switch that allows resistor R4' to be removed. A new switch such as that shown in FIGs. 4a and 4b will replace a neutral tab such that upon depressing the reset button, when the test is required, it will be accomplished using a neutral fault.

Referring to Fig. 1, a GFCI is described having an electrical test and bridge circuit according to the present application. As can be appreciated a test trip is accomplished by pushing button 26 that closes the test circuit through current limiting resistor R4 to create a simulated ground fault to trip the device.

Referring to FIG. 2 a schematic diagram of a GFCI having an independent trip such as a mechanical trip for a test button and an electrical ground fault simulation test for reset lockout according to the present application is shown. As can be appreciated, the reset lockout test is accomplished by using a ground fault simulation through current limiting resistor R4'.

Referring to Fig. 3 a schematic diagram of a GFCI having an independent trip such as a mechanical trip for a test button and a mechanical switch (electrical test) for a neutral fault simulation test for reset lockout according to the present application is

shown. As can be appreciated, the schematic shown has an independent mechanical trip for a test, but could have an electrical ground fault simulation test. Similarly, the test button may also fire a neutral fault test simulation. As shown the rest lockout test is accomplished by switch S1 closing and completing a circuit from the line neutral 38 to the load neutral 40. This circuit creates a feedback path that will trigger the device if it is working properly and the reset will be allowed. As can be appreciated, an open neutral fault can be protected against using a continuous duty solenoid K2 which will open the line side if power drops out such as an open neutral.

The neutral fault condition simulated is generally providing a low impedance path through the two transformers of the GFCI. As can be appreciated, a switch similar to S1 may accomplish a fault simulation by switching a circuit from the line phase 34 to the load phase 36.

Certain circuit interrupters do not allow convenient access to the line side. In such situations and others such as high current devices, a third sense line may be used. A third wire through the sense transformers to simulate a fault.

Referring to FIG. 4, an particular neutral fault simulation switch is shown that may be used with the GFCI devices shown above.

As noted, although the components used during circuit interrupting and device reset operations are electro-mechanical in nature, the present application also contemplates using electrical components, such as solid state switches and supporting circuitry, as well as other types of components capable or making and breaking electrical continuity in the conductive path.

While there have been shown and described and pointed out the fundamental features of the invention, it will be understood that various omissions and substitutions and changes of the form and details of the device described and illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention.